

# Pesticides

*In the 1960s, Agent Orange was applied on Kenai National Wildlife Refuge for moose browse improvement.*

Historically, pesticides have been used on the refuge to eradicate spruce and tall deciduous trees for moose browse improvement and to prevent fence posts from rotting. Some of the pesticides applied on the refuge were dybar, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and pentachlorophenol (PCP), all of which will be discussed in further detail in this section. The chemical abstract (CAS) numbers, synonyms, physical/chemical properties, environmental fate characteristics and toxicological effects for each chemical discussed in this section are located in Appendix G.

The first mention of pesticide use on the refuge occurs in the May-August 1954 Narrative, which states:

*A Federal Aid Project was started to test the value of various herbicides in eradicating spruce and tall deciduous trees for range improvement. Plots were treated by ground sprays on a plot adjacent to the control burn plot on Slikok Lake and in the Chickaloon Bay area. A plot was treated by aerial spraying in the Chickaloon Bay area. Observations on these plots for the season are not yet complete.*  
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This is the only information the May-August 1954 Narrative provides. It does not contain specific information concerning which herbicides were used, the amounts applied or the exact locations of use.

Although, the Annual Narratives provide some information about historic pesticide use on the refuge, they may not detail all pesticide uses on the refuge. In fact, the next mention of pesticide use does not occur until 1959.

All known pesticide application events on the refuge, as documented in the Annual Narratives, are listed in Table 1. The narratives did not provide exact application locations in many instances.

## Dybar

Dybar (fenuron) was applied at certain locations on the refuge for moose browse improvement in 1959 and 1961 (Table 1). Dybar readily biodegrades in terrestrial environments, with a half-life of approximately two to five months depending on ambient temperature. In aquatic environments, dybar also will biodegrade readily. Additionally, dybar will not bioconcentrate in aquatic organisms. Because dybar was applied on the refuge several decades ago and it rapidly biodegrades in the environment, residual dybar contamination is likely not an issue for the refuge.

**Table 1. Pesticides Applied on Kenai National Wildlife Refuge as Documented in the Annual Narratives.**

<i>Pesticide(s)</i>	<i>CAS#</i>	<i>Dates Applied</i>	<i>Application Rate</i>	<i>Application Location</i>
Dybar	101-42-8	June 1959	Unknown	4 test plots
Dybar	101-42-8	April 12, 13 and 19, 1961	10 to 80 pounds/acre (pellet form)	31 plots, 1/10 acre each in 6 cover types*
2,4-D and 2,4,5-T used separately and in mixtures	94-75-7 and 93-76-5	June 1964	Various**	24 plots, 1/100 acre in the Naptowne area
50:50 ratio of 2,4-D and 2,4,5-T (Agent Orange)	94-75-7 and 93-76-5	June 15, 1966	4 pounds/acre in a mixture of 30 gallons of water (aerially sprayed)	10 acre plot directly south of Grus Lake, north of Swanson River

\*More information regarding location, cover types treated and treatment results is contained in Appendix H.

\*\*More information regarding this application and treatment results is contained in Appendix I.

*Dioxin is recognized by the National Toxicology Program as a “known human carcinogen.”*

*There are 75 polychlorinated dibenzo-p-dioxin (PCDD) congeners and 135 polychlorinated dibenzofuran (PCDF) congeners; the number of chlorine atoms can vary from one to eight. The toxicity of PCDD/PCDF compounds is related to chlorine atoms occupying the 2,3,7 and 8 positions.*

*2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF) are considered extremely toxic. 2,3,7,8-TCDD is often called dioxin, even though 2,3,7,8-TCDD is just one of the 75 dioxin congeners. 2,3,7,8-TCDD will be called dioxin or TCDD throughout this document. The plural term “dioxins” will be used when referring to more than one dioxin congener.*

### **2,4-D, 2,4,5-T and Dioxin**

The first mention of 2,4-D and 2,4,5-T use occurs in the January-April 1963 Narrative. Apparently 2,4-D and 2,4,5-T were ordered for brush control use during the summer of 1963. However, the narrative does not expand on if and where the chemicals were applied that year. The known application dates, locations and application rates for 2,4-D and 2,4,5-T are listed in Table 1.

The application of 2,4-D and 2,4,5-T has generated considerable controversy due to their extensive use as a defoliant in the Vietnam War. During the war, the U.S. military called a 50:50 mixture of 2,4-D and 2,4,5-T, “Agent Orange,” due to the orange stripes on drums which contained this 50:50 mixture.

One major concern with 2,4,5-T is contamination with 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin or TCDD). Dioxins are a byproduct of 2,4,5-T manufacturing. The TCDD contamination in Agent Orange ranged from 1.77 to 40 ppm (Moore, <http://dns.advnet.net/gdmoore/aotalk1.htm>). Dioxin is thought to cause a variety of human health effects and is categorized by the International Agency for Research on Cancer (part of the World Health Organization) as a human carcinogen. Dioxin is also recognized by the National Toxicology Program as a “known human carcinogen.” Additionally, dioxin may bioconcentrate in aquatic organisms and is suspected to cause reproductive toxicity in some wildlife species. In 1985, use of 2,4,5-T was banned in the United States due to concerns about dioxin contamination.

### **Pentachlorophenol**

The refuge narratives never detailed any use of PCP on the refuge, and it was not until a 1991 refuge-wide inventory of potentially contaminated sites that PCP contamination was discovered (ADEC spill number 94-23-09-096-02).

PCP was used on the refuge in the 1960s and 1970s to treat fence posts during construction of perimeter fencing for the Moose Research Center, a cooperative moose research effort between USFWS and the Alaska Department of Fish and Game. Precut



*Site investigation for pentachlorophenol contamination at the Moose Research Center. USFWS Photo by James E. Frates.*

spruce posts were soaked in a mixture of PCP and diesel fuel to prevent the poles from eventually rotting. Prior to being placed in the ground, the butt ends of the poles were soaked in sealed concrete culverts for several days. The treatment location is known as the Swan Lake 1 exploratory well drill site (an abandoned oil well pad drilled in 1961).

The release of PCP and diesel range organics (DRO) at the site occurred from spillage, overflow and drip-drying activities. There are no records to indicate how many culverts were used, how many posts were treated or how much PCP was applied. Soils at the site had PCP concentrations up to 300 ppm. Concrete culverts had PCP concentrations from 3 to 450 ppm. Dioxins and furans were also detected at the site, but TCDD was not one of the dioxins detected.

Currently, the use of PCP is restricted in the United States. Like 2,4,5-T, PCP also is infamous for containing dioxins. PCP contains a wide variety of dioxins (virtually every possible isomer) with the higher chlorinated congeners predominating. The concentration of total dioxins in PCP is in the mid-to-high ppm range, and the primary dioxin congener in PCP is octachlorodibenzo-p-dioxin, which is about as toxic as table salt (Shadoff, [http://www.geocities.com/Athens/1309/d\\_where2.html](http://www.geocities.com/Athens/1309/d_where2.html)).

Cleanup plans were initiated in 1993, and debris and several culverts were removed from the site. In April 1988, ADEC determined the site required no further action. However, according to the ADEC, both DRO and PCP subsurface contamination remain at levels which may pose a human/ecological health risk. To alleviate possible risks, the ADEC mandated the following institutional controls:

- 1) site access by unauthorized individuals will be restricted by a locked gate

- 2) the site will not be developed other than to be used as a temporary storage area
- 3) no groundwater well will be installed at the site; and
- 4) no activity that may disturb subsurface soils may occur.

### Summary: Pesticides

Currently, no pesticides are used on the refuge, and any pesticide use must first be approved by the Pesticide Coordinator at the USFWS Regional Office in Anchorage, Alaska.

Although several pesticides were applied at the refuge, it is possible that these chemicals have degraded over the years and no longer pose contamination threats. One concern, however, is the persistence of dioxin in the environment. Dioxin is considered resistant to biodegradation, and half-lives in soil interiors are estimated at 12 years (<http://www.speclab.com/compound/c1746016.htm>) and perhaps longer in colder climates, like Alaska. Dioxin contamination could still be an issue in areas where 2,4,5-T was applied.